

# Evolution of Life

---

Douglas Wilkin, Ph.D.  
Jean Brainard, Ph.D.

**Say Thanks to the Authors**

Click <http://www.ck12.org/saythanks>

*(No sign in required)*

To access a customizable version of this book, as well as other interactive content, visit [www.ck12.org](http://www.ck12.org)

CK-12 Foundation is a non-profit organization with a mission to reduce the cost of textbook materials for the K-12 market both in the U.S. and worldwide. Using an open-content, web-based collaborative model termed the **FlexBook®**, CK-12 intends to pioneer the generation and distribution of high-quality educational content that will serve both as core text as well as provide an adaptive environment for learning, powered through the **FlexBook Platform®**.

Copyright © 2012 CK-12 Foundation, [www.ck12.org](http://www.ck12.org)

The names “CK-12” and “CK12” and associated logos and the terms “**FlexBook®**” and “**FlexBook Platform®**” (collectively “CK-12 Marks”) are trademarks and service marks of CK-12 Foundation and are protected by federal, state, and international laws.

Any form of reproduction of this book in any format or medium, in whole or in sections must include the referral attribution link <http://www.ck12.org/saythanks> (placed in a visible location) in addition to the following terms.

Except as otherwise noted, all CK-12 Content (including CK-12 Curriculum Material) is made available to Users in accordance with the Creative Commons Attribution/Non-Commercial/Share Alike 3.0 Unported (CC BY-NC-SA) License (<http://creativecommons.org/licenses/by-nc-sa/3.0/>), as amended and updated by Creative Commons from time to time (the “CC License”), which is incorporated herein by this reference.

Complete terms can be found at <http://www.ck12.org/terms>.

Printed: January 2, 2013

**flexbook**  
next generation textbooks



## AUTHORS

Douglas Wilkin, Ph.D.

Jean Brainard, Ph.D.

## CONCEPT

## 1

# Evolution of Life

- Explain how life on Earth evolves.



## Are dinosaurs evidence of past life forms?

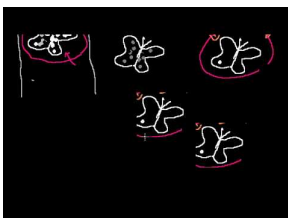
Evolution can be described as *a change in species over time*. Dinosaur fossils are significant evidence of evolution and of past life on Earth.

## Evolution of Life

The diversity of life on Earth today is the result of evolution. Life began on Earth at least 3.5 to 4 billion years ago, and it has been evolving ever since. At first, all living things on Earth were simple, single-celled organisms. Much later, the first multicellular organisms evolved, and after that, Earth's biodiversity greatly increased. **Figure 1.1** shows a timeline of the history of life on Earth. You can also find an interactive timeline of the history of life at the link below. <http://www.johnkyrk.com/evolution.html>

Today, scientists accept the evolution of life on Earth as a fact. There is too much evidence supporting evolution to doubt it. However, that wasn't always the case.

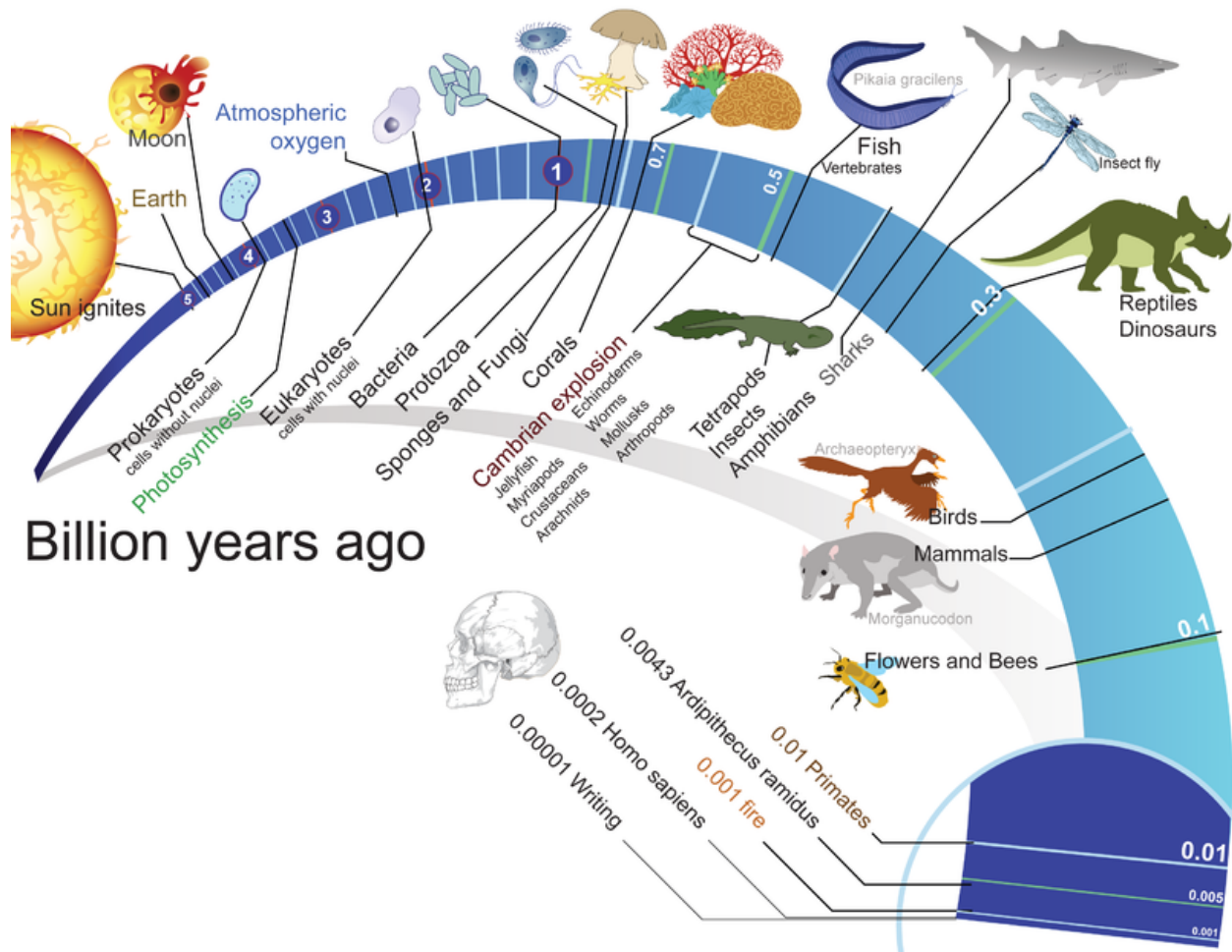
An introduction to evolution and natural selection can be viewed at <http://www.youtube.com/watch?v=GcJgWov7mTM>.



### MEDIA

Click image to the left for more content.

As you view *Introduction to Evolution and Natural Selection*, focus on these concepts:



**FIGURE 1.1**

This timeline shows the history of life on Earth. In the entire span of the time, humans are a relatively new addition.

1. the relationship between evolution and natural selection,
2. the relationship between natural selection and variation,
3. the evolution of the peppered moth.

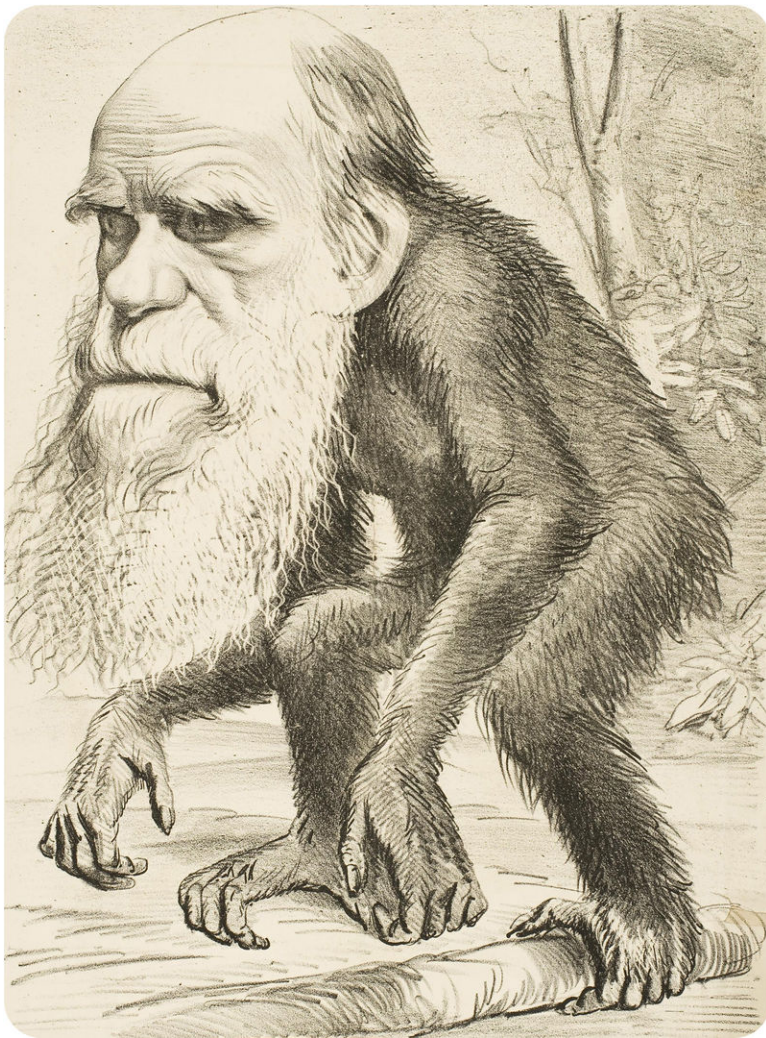
## Darwin and the Theory of Evolution

The idea of evolution has been around for centuries. In fact, it goes all the way back to the ancient Greek philosopher Aristotle. However, evolution is most often associated with Charles Darwin. Darwin published a book on evolution in 1859 titled *On the Origin of Species*. In the book, Darwin stated the theory of evolution by natural selection. He also presented a great deal of evidence that evolution occurs.

**Evolution** is a change in the characteristics of living things over time. As described by Darwin, evolution occurs by a process called **natural selection**. In natural selection, some members of a species produce more offspring than others, so they pass "advantageous traits" to their offspring. Over many generations, this can lead to major changes



in the characteristics of the species. Evolution explains how living things are changing today and how modern living things have descended from ancient life forms that no longer exist on Earth. As living things evolve, they generally become better suited for their environment. This is because they evolve adaptations. An **adaptation** is a trait that helps an organism survive and reproduce in a given environment. Despite all the evidence Darwin presented, his theory was not well-received at first. Many people found it hard to accept the idea that humans had evolved from an ape-like ancestor, and they saw evolution as a challenge to their religious beliefs. Look at the cartoon in **Figure 1.2**. Drawn in 1871, it depicts Darwin himself as an ape. The cartoon reflects how many people felt about Darwin and his theory during his own time. Darwin had actually expected this type of reaction to his theory and had waited a long time before publishing his book for this reason. It was only when another scientist, named Alfred Wallace, developed essentially the same theory of evolution that Darwin put his book into print.

**FIGURE 1.2**

Charles Darwin's name is linked with the theory of evolution. This cartoon from the 1870s makes fun of both Darwin and his theory.

Although Darwin presented a great deal of evidence for evolution in his book, he was unable to explain how evolution occurs. That's because he knew nothing about genes. As a result, he didn't know how characteristics are passed from parents to offspring, let alone how they could change over time.

## Evolutionary Theory After Darwin

Since Darwin's time, scientists have gathered even more evidence to support the theory of evolution. Some of the evidence comes from fossils, and some comes from studies that show how similar living things are to one another. By the 1930s, scientists had also learned about genes. As a result, they could finally explain how characteristics of organisms could pass from one generation to the next and change over time.

Using modern technology, scientists can now directly compare the genes of living species. The more genes different species share in common, the more closely related the species are presumed to be. Consider humans and chimpanzees. They share about 98% of their genes. This means that they shared a common ancestor in the not-too-distant past. This is just one of many pieces of evidence that show we are part of the evolution of life on Earth.

## Misconceptions About Evolution

Today, evolution is still questioned by some people. Often, people who disagree with the theory of evolution do not really understand it. For example, some people think that the theory of evolution explains how life on Earth first began. In fact, the theory explains only how life changed after it first appeared. Some people think the theory of evolution means that humans evolved from modern apes. In fact, humans and modern apes have a common ancestor that lived several million years ago. These and other misconceptions about evolution contribute to the controversy that still surrounds this fundamental principle of biology.

## Summary

- Life began on Earth at least 3.5 to 4 billion years ago, and it has been evolving ever since.
- Darwin stated the theory of evolution by natural selection, presenting a great deal of evidence to support his theory.
- Evolution is a change in the characteristics of living things over time. Evolution occurs by natural selection.
- Characteristics of organisms are passed from one generation to the next through their genes.

## Making Connections



### MEDIA

Click image to the left for more content.

## Practice

Use this resource to answer the questions that follow.

- <http://www.hippocampus.org/Biology> → Non-Majors Biology → Search: **Darwinian Evolution**

1. Who was Charles Darwin?
2. What did Darwin conclude about homologous structures?
3. Why are some traits more likely to be passed to the next generation?
4. What is the outcome of natural selection?

## Review

1. What is evolution?
2. What is natural selection?
3. Explain the theory of evolution.